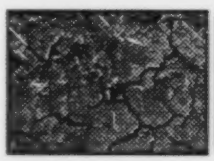
Coriander - The Economics and Agronomics of New Crops

Adaptation | Seeding | Fertilization | Weed Control | Insect Control | Disease Control | Harvesting | Storage | Processing and Grading | Coriander Statistics - Production and Trade | Production Economics | Additional Information |

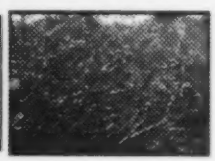
Last Updated: July 15, 1998

Introduction



Cotyledon to Two Leaf Stage

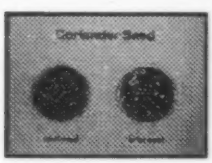
Flowering Stage



Mature

Coriander (*Coriandrum sativum*) is an annual spice crop and a member of the Umbelliferae or carrot family. It has an erect, branching stem growing to a height of about 0.6 metres (2 feet). The fresh green herb is used in East Indian, Chinese, and Mexican cooking (where it is known as cilantro or chinese parsley). The mature, round fruit consists of two fused hemisphere-shaped seeds and is harvested and marketed intact. Mature seeds have a pleasant, spicy aroma. Coriander powder is made from ground seeds and is used to flavour many food products such as curry, gin or prepared meats.

The two types of coriander are the large seeded and the small seeded. The large seeded type (diameter of 3 to 5 mm) is grown as a winter crop in areas with a Mediterranean-type climate, and as a spring crop in northern temperate climates. Saskatchewan produces mainly the large-seeded type. Large-seeded coriander grown in Saskatchewan has an oil content of 0.5 to 1%. Its days-to-harvest requirement is approximately 100 days.



The small-seeded (cilantro) type is produced mainly in moderate temperate regions. It has a longer days-to-harvest requirement (approximately 120 days). Small-seeded coriander is somewhat taller, and contains more essential oil. Small-seeded coriander grown in Saskatchewan has an oil content of 1 to 1.5%. Volatile oils such as linalool are responsible for the aroma of coriander. The oil of coriander should contain 60 to 70% linalool.

Production of coriander in Saskatchewan has increased to about 8,500 ha (21,000 acres) in 1997. Average yield of large-seeded coriander in Saskatchewan is approximately 900 kg/ha (800 lbs/acre). Small-seeded coriander yield can be slightly more, if it matures. The bushel weight of large seeded coriander is 22 to 25 lbs.

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Adaptation

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Coriander is a heat-loving crop. It may be grown on a fairly wide range of soils, but is best adapted to well-drained loam and sandy-loam soils. Soil Texture Triangle Coriander germinates very slowly and may take as long as 21 days to emerge. It does not compete successfully with weeds, especially perennial weeds, and should be planted on clean land. Plants can suffer flower blast if hot, dry conditions occur at bloom. This can significantly lower yields. Coriander yields can be improved through the use of honey bees as pollinators. The Saskatchewan Herb and Spice Association publication, "The Grower's Guide to Herbs and Spices", contains more information on adaptation and suitability of coriander to specific areas of Saskatchewan.

Suitability Map for Coriander in Saskatchewan

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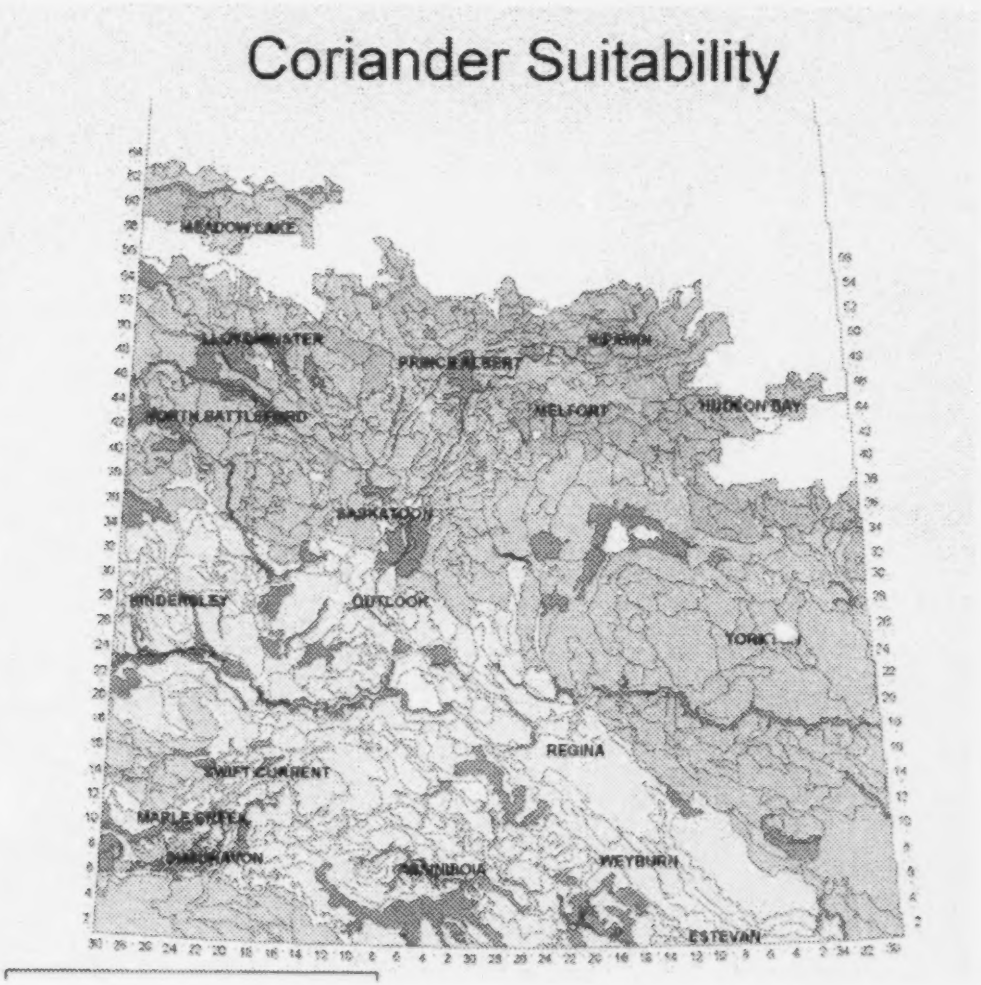
CORIANDER - Soil, Climate and Landscape Suitability

Last Updated: March 11, 1996

See notes below map

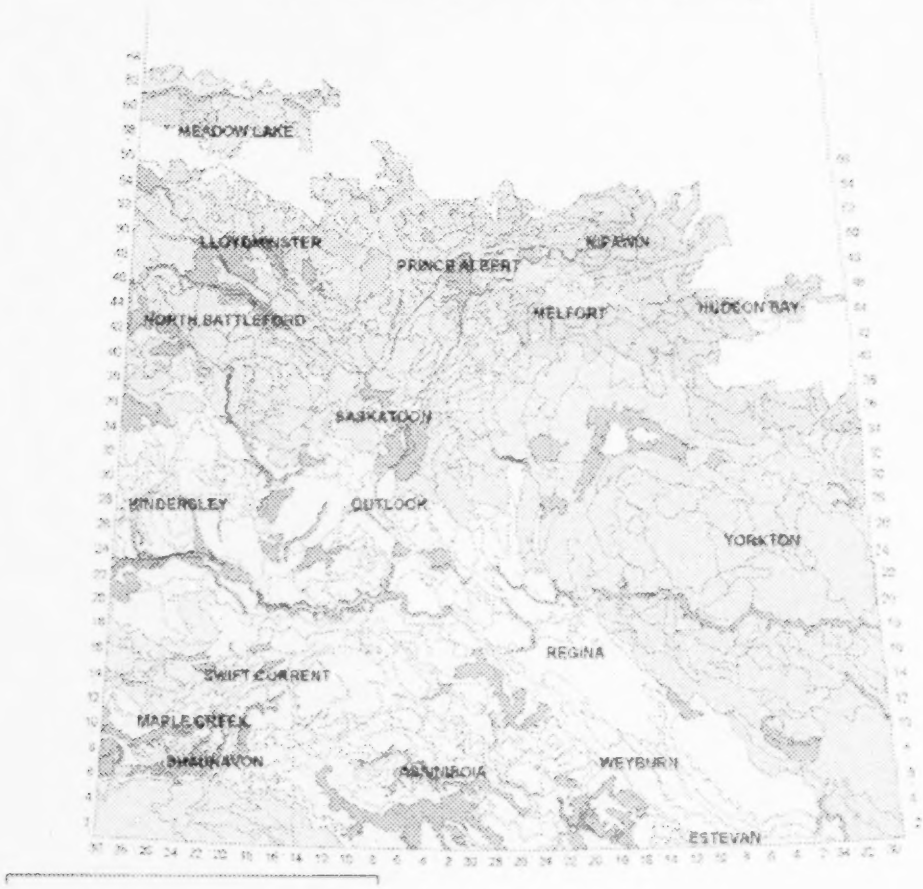


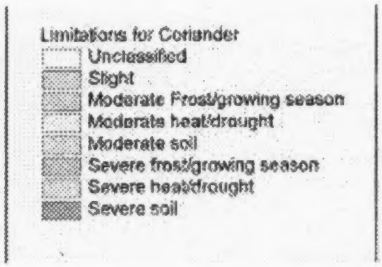
CORIANDER - Soil, Climate and Landscape Suitability

Last Updated: March 11, 1996

See notes below map

Coriander Suitability





Produced by:
Saskatchewan Centre
for Soil Research
February 28, 1995

Funded by:
Saskatchewan Agriculture
Agriculture Development Fund

Produced by:

The Saskatchewan Land Resource Unit
The Saskatchewan Centre for Soil Research
Department of Soil Science
University of Saskatchewan, Saskatoon

Funded by: Saskatchewan Department of Agriculture and Food

Map Scale: 1:5,000,000 **Date:** February 28, 1995

Soil and Climate Map Based On:

Agroecological Resource Area Database for Saskatchewan (1993) - Centre for Land and Biological Resources Research

Soil Climatic Zones of Southern Saskatchewan (1991) - J.L. Henry and H.K. Harder, Saskatchewan Institute of Pedology, University of Saskatchewan.

Map Legend Explanation:

Slight Limitation	Areas which have the least limitations to crop production
Moderate Frost/growing season limitation	Length of growing season and/or risk of frost is a moderate limitation to crop production.
Moderate Heat/Drought limitation	Excessive heat and/or lack of precipitation is a moderate limitation to crop production
Moderate Soil limitation	Soil/landscape factors such as salinity, slope and topography, stones, soil pH and soil texture moderately limit crop production
Severe Frost/growing season limitation	Length of growing season and/or risk of frost is a severe limitation to production.
Severe Heat/Drought limitation	Excessive heat and/or lack of precipitation is a severe limitation to crop production.
Severe Soil limitation	Soil/landscape factors such as salinity, slope and topography, stones, soil pH and soil texture severely limit crop production.

References:

ECOCROP 1: The Adaptability Level of the FAO Crop Environmental Requirements Database. Soil Resources Management and Conservation Service (AGLS), Food and Agriculture Organization of the UN. 1994.

Farm Facts - Coriander. Saskatchewan Agriculture and Food Publication.

*** Maps are based on limited agronomic data for the province. Maps will be updated when additional grower and research information is available.**

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Seeding

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The recommended seeding rate for large-seeded coriander is 20 kg/ha (19 lbs/acre). Two seeds are contained in a spherical fruit, which should be seeded intact. However, research results indicate no significant yield differences between using intact or split fruits as seed, provided germination levels are high (>80%). The recommended seeding depth is 2.5 to 4 cm (1 to 1.5 inch). Coriander requires a firm, moist seedbed to enhance germination and speed plant emergence. Any seeding equipment that will provide these conditions is suitable, however, the use of a press drill has been most successful to date. The seeder should be adjusted so that it does not damage the seed.

Coriander should be seeded in late April to mid May. The crop may take 21 or more days to emerge, and has some tolerance to light spring frost. Research results have indicated higher seed yields and oil levels can be achieved by seeding earlier than May 20. Seeding into dry soil can delay germination.

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Fertilization

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Coriander, like all plants, requires both macro and micronutrients. Most Saskatchewan soils are low in nitrogen and phosphorus, many are low in sulphur, and some are low in potassium and/or one or more micronutrients.

Coriander fertility trials have not been completed in Western Canada, however a review of fertility trials from other countries was completed by Henry Perspectives and funded by the Saskatchewan Agriculture Development Fund in March 1996. Extrapolating this information to Saskatchewan growing conditions indicates that coriander will likely require a level of nutrients similar to cereals and oilseeds.

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Soil testing will provide a good 'ballpark' assessment of soil nutrient levels prior to seeding. Tissue testing will allow for refinement of fertilizer application. Soil and tissue testing and proper fertilization can be particularly beneficial with a high value crop such as coriander.

The maximum safe rate of fertilizer applied with the seed of coriander under Saskatchewan conditions has not been studied. Until such work can be done it is recommended that seed-placed fertilizer not exceed 20 lb P2O5 per acre as monoammonium phosphate, with 1 inch spread and 6 to 7 inch row spacing, under good to excellent soil moisture conditions. Recent results from research carried out in Saskatchewan indicate that increasing levels of nitrogen fertilizer from 30 kg/ha to 90 kg/ha did not improve the seed yield or essential oil content.

For further information on fertilizers and their application, refer to the Saskatchewan Agriculture & Food FarmFacts bulletins dealing with fertilization.

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Weed Control

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Coriander may take 21 days to emerge after planting, and is not a good competitor to weeds. Severe weed competition can occur unless the crop is grown on clean land. Control of perennial weeds in coriander is very difficult.

EDGE® herbicide is registered for use in coriander to control annual grassy weeds (wild oats, green and yellow foxtail, barnyard grass), and annual broadleaf weeds (kochia, wild buckwheat, redroot pigweed, lamb's-quarters, cow cockle, purslane, chickweed, corn spurry and prostrate pigweed).

POAST® herbicide is registered in coriander for the control of annual grassy weeds. Some producers use a post-planting application of

ROUNDUP® to control grassy and broadleaf weeds in the time period between planting and emergence of the coriander.

AFOLAN® F (linuron) is registered for post-emerge control of wild mustard in coriander. Consult and follow label directions.

Consult and follow the label directions. Research is under way to register a post-emerge annual broadleaf weed herbicide for coriander.

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Insect Control

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Grasshoppers can be a pest in coriander. Grasshopper heads in the seed sample can cause down grading or rejection. Leaf hopper can also be of economic importance in that it is the vector for aster yellows disease. No insecticides are registered for use in this crop.

Saskatchewan Grasshopper Forecast

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Disease Control

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Several commonly occurring root diseases such as damping off and seedling rot can infect coriander seedlings. Symptoms of these diseases include yellowing and death of newly emerged seedlings. Research results indicate that seed applied fungicides have no consistent effect in improving seed yield in coriander. Crop rotations which provide a break from members of the carrot family for several years will help to prevent the build up of root rot problems.

Aster yellows is a plant disease which commonly infects members of the carrot family. Caraway and dill are more susceptible than coriander. Aster yellows is a virus-like disease that is spread by leaf hoppers. Aster yellows causes yellowing of infected flower parts at the time of flowering. The infected plants will often be slightly taller than unaffected plants and will not set seed. The disease is spread from infected to healthy plants when the leaf hoppers move into a new area.

No crop protection products are registered for the control of aster yellows in coriander. Crop rotations where no members of the carrot family are planted in the field or no volunteer plants are allowed to reach the flowering stage can reduce the disease. Attempts should be made to control the spread of leaf hoppers into the crop area.

Crop injury near maturity from hail or heavy rain can lead to discolouration of the fruit, and down grading of the sample. Sooty mould is a fungal disease which can develop on the stems and fruits under these conditions. It can cause further (darker) discolouration of the sample. The crop should be harvested as soon as possible to prevent deterioration in the field.

Anthracnose and Alternaria were first identified in coriander in Saskatchewan in 1996. Significant crop loss resulted from the infestation of these diseases. Their spread seems to be linked to a short rotation between coriander crops.

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Harvesting

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Swathing - Swath coriander when the fruit colour becomes tan to brown. Shattering is not a severe problem, however, swathing in damp weather or when dew is present will help to avoid losses.

Combining - Alternatively, one can straight combine when the crop is fully mature. Combine when the moisture content is less than 15%. A moisture content of 10% is considered dry, but many buyers prefer a moisture content of 9 %. Cylinder or rotor speed should be set at about 500 r.p.m. under dry conditions. An initial concave setting of 20 mm (0.5 inch) at the front, and 10 mm (0.25 inch) at the back is suggested. Wind speed should be kept low, and the return should be minimized as much as possible. Reduced ground speed may be required. Coriander containing over 5 % split fruit is usually discounted at time of purchase.

For 10 % moisture on a 3.5" Moisture Meter, use the sunflower chart; a 150 g sample; and calibrate @73.

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Storage

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Coriander oil is very volatile. The seed must cure during storage. Natural air drying (aeration) assists this curing. Avoid hot air drying if possible. Green material should be cleaned from the sample as soon as possible. Avoid the concentration of green material such as green weed seeds in one location in the bin. The concentration of the green material is denser than the coriander seeds. The higher density prevents proper aeration in that the air is diverted and the concentrated green material spoils. The sample must be free of evidence of rodents and other foreign material at the time of sale.

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Processing and Grading

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Coriander should be cleaned to the standards set by the American Spice Trade Association. A high percentage of clean out often occurs during cleaning. Dockage levels of 15 to 20 % are common. A growing number of businesses in Saskatchewan have experience in cleaning and bagging spices crops such as coriander. A list of these businesses is available at Rural Service Centres in Saskatchewan.

Coriander is graded by the buyer according to its aroma and appearance. Factors such as colour, stems, splits, and foreign material are taken into account. Buyers prefer a light tan colour with at least 99% pure whole seed.

% Essential Oil and % Active Ingredient of spice crops grown in Saskatchewan 1994 - 1996

Spice	% Essential Oil	%Active Ingredient
Coriander - Small-seeded	1.1 - 1.4	60 - 70 % linalool
Coriander - Large-seeded	0.7 - 0.9	60 - 70 % linalool
Caraway - Annual	2.5 - 4.9	45 - 51 % carvone 49 - 55 % limonene
Caraway - Biennial	3.9 - 6.6	53 - 55 % carvone 45 - 47 % limonene
Dill	2.6 - 4.6	39 - 48 % carvone

Source: G.C. Arganosa, A.E. Slinkard, F.W. Sosulski; University of Saskatchewan

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Coriander Statistics

Last Updated: September 25, 1996

- United States imports of coriander from Canada 1993-Sept/96
- United States imports of coriander: total and Canada 1993-Sept/96
- United States imports of coriander from five largest suppliers 1993-Sept/96
- Total United States coriander seed imports (1,000 kg) 1974-Sept/96

- Value of United States imports of coriander from Canada 1993-Sept/96
- Value of United States imports of coriander: total and Canada 1993-Sept/96
- Value of United States imports of coriander from five largest suppliers 1993-Sept/96

- Average price paid for coriander imported by the United States from Canada 1993-Sept/96
- New York Wholesale prices (weekly)
- New York Wholesale prices (annual)

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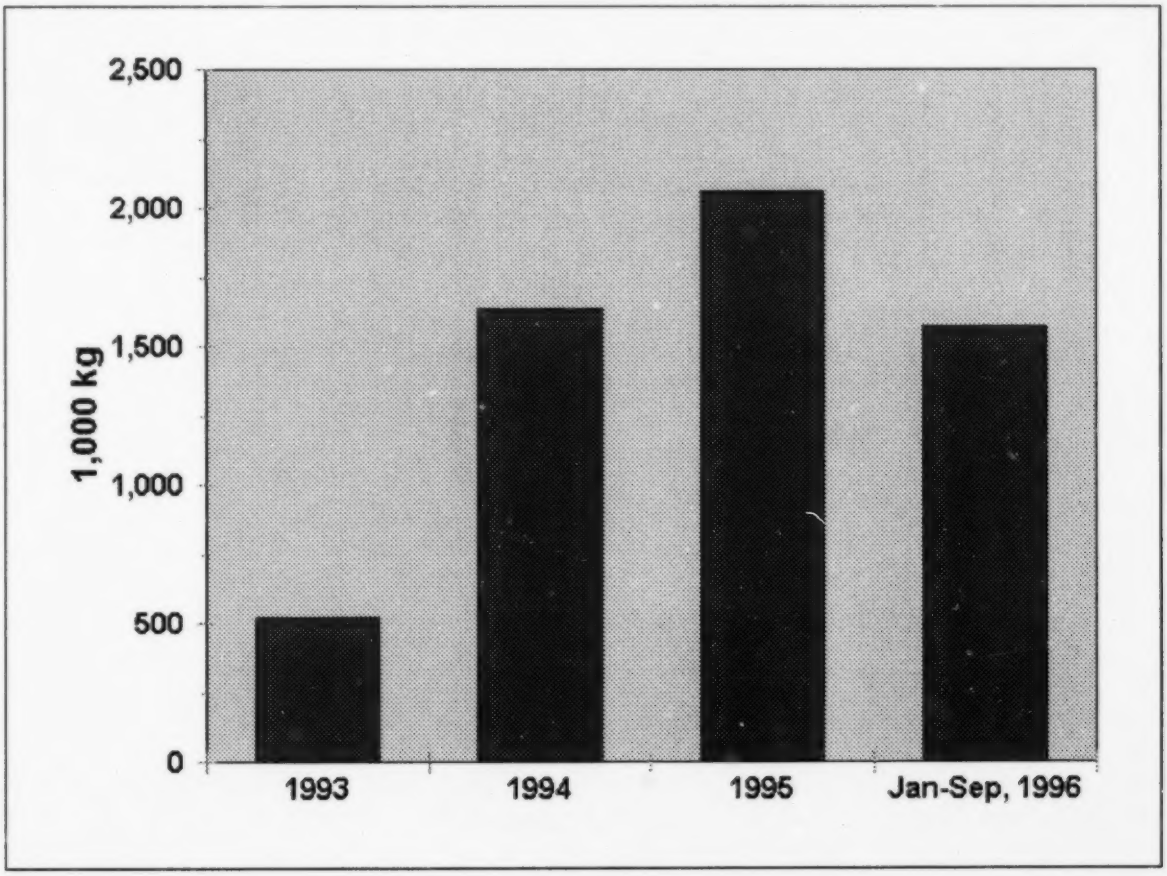
Agronomics and Economics of New Crops - Coriander Statistics

United States imports of coriander from Canada

1993-Sept/96 ('000 kg)

Source: US Department of Commerce 1997



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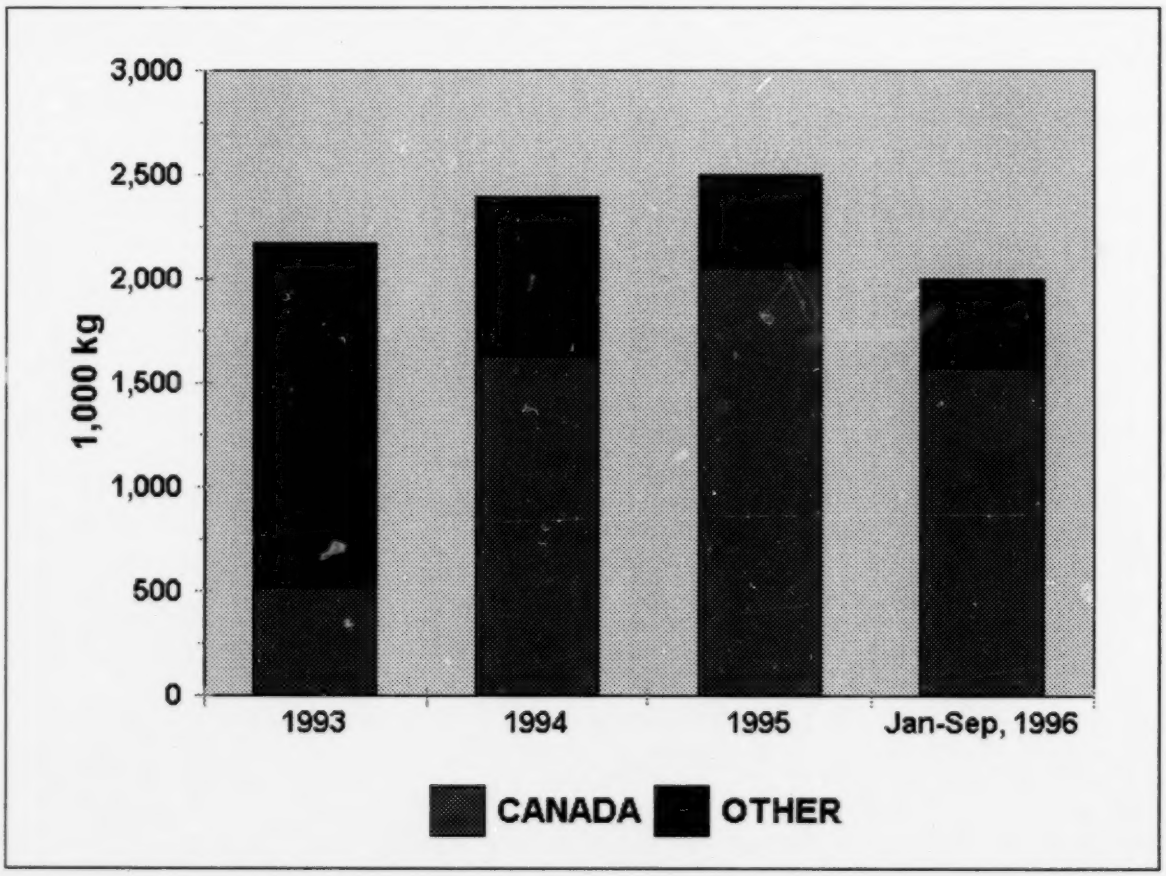
United States imports of coriander: total and Canada

1993-Sept/96 ('000 kg)

Source: US Department of Commerce 1997



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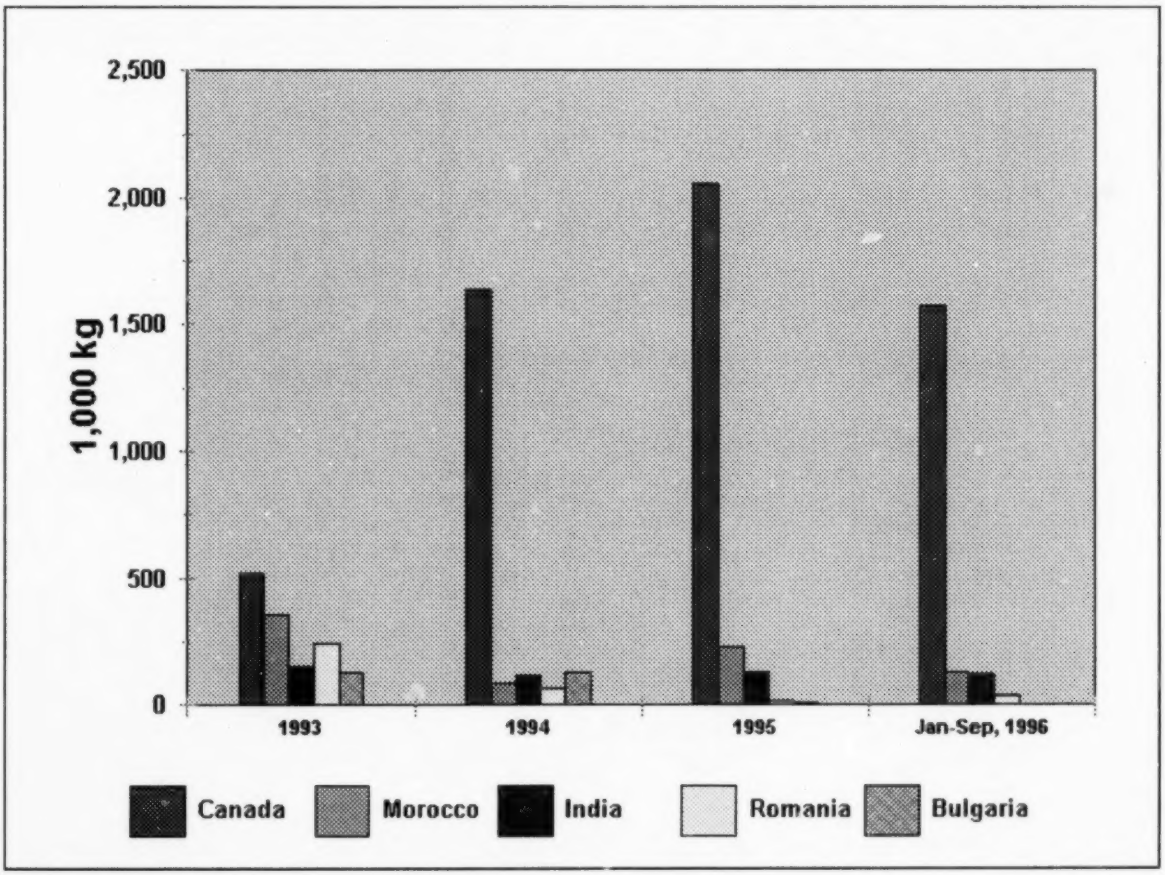
Agronomics and Economics of New Crops - Coriander Statistics

United States imports of coriander from five largest suppliers

1993-Sept/96 ('000 kg)

Source: US Department of Commerce 1997



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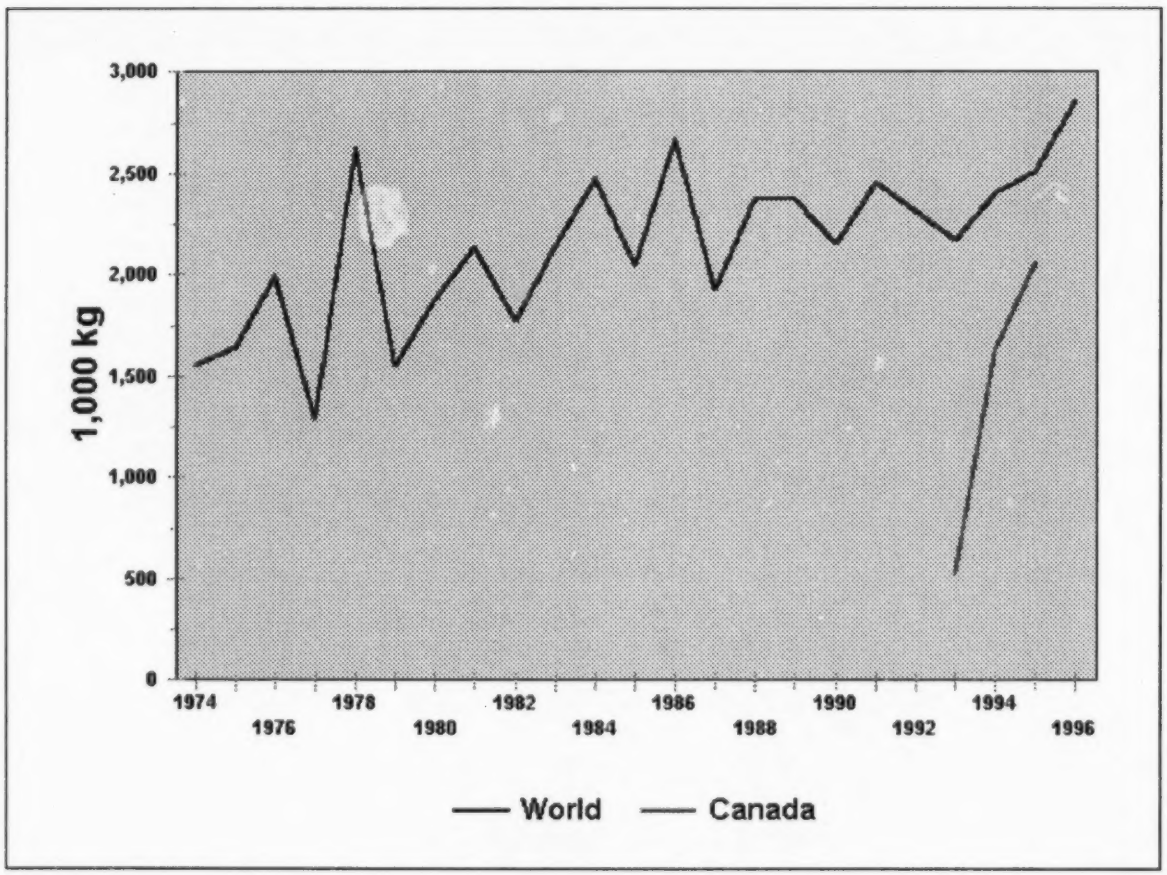
United States coriander seed imports: total and Canada

1974-Sept/96 ('000 kg).

US Department of Commerce 1993-96



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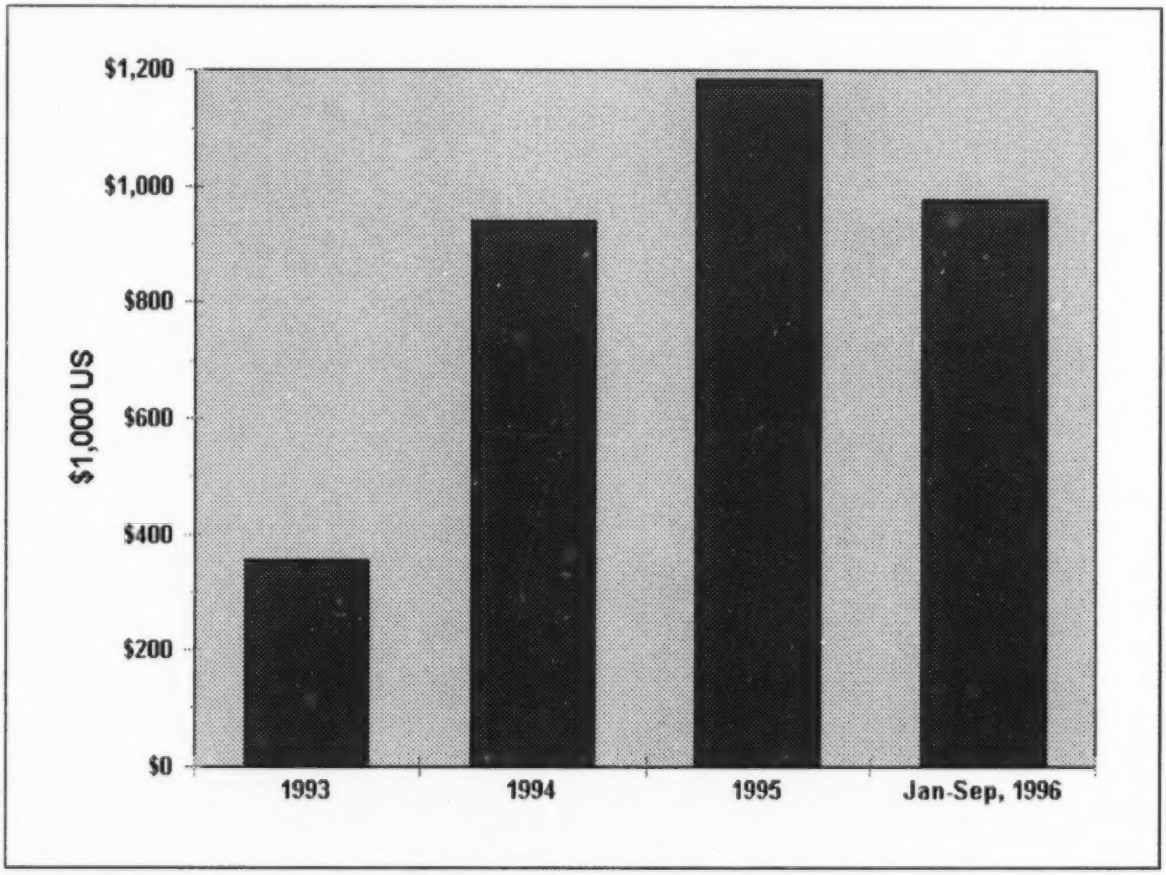
Value of United States imports of coriander from Canada

1993-Sept/96 ('000 US$)

Source: US Department of Commerce 1997



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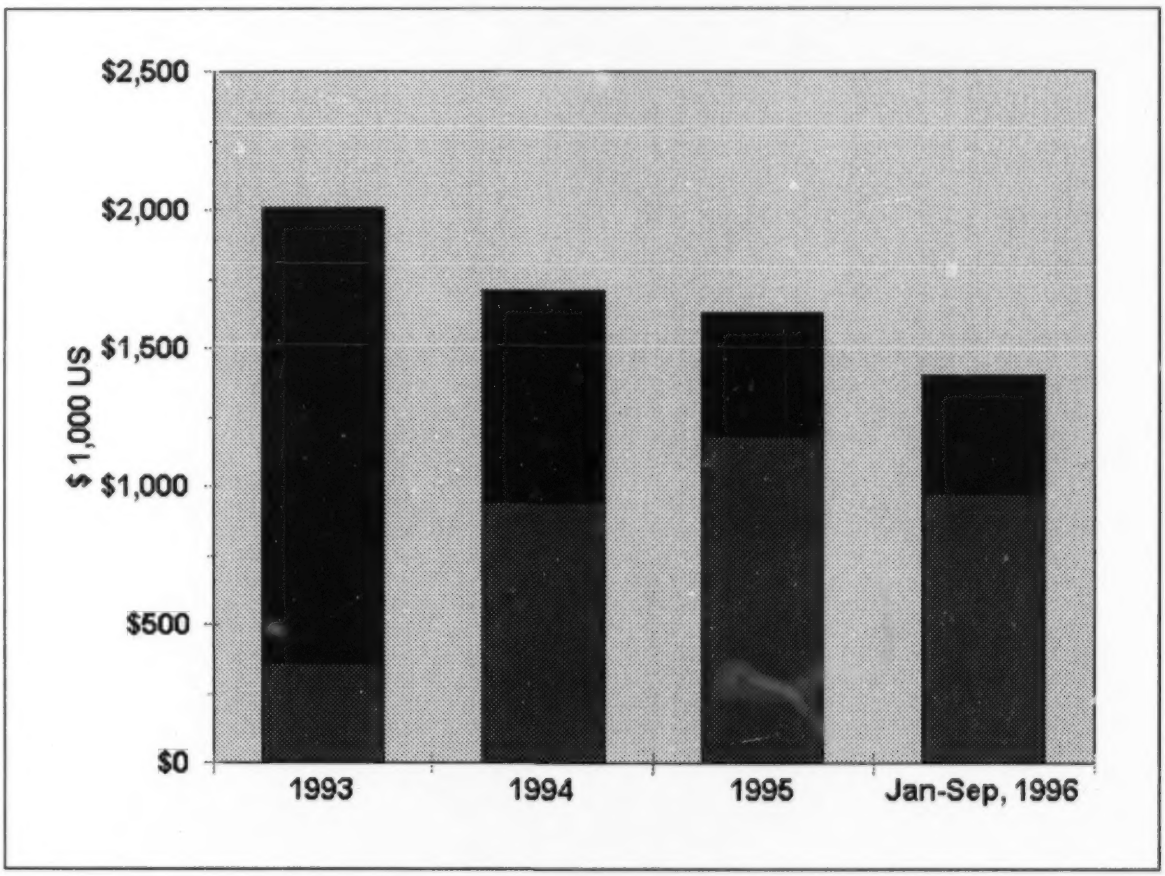
Value of United States imports of coriander: total and Canada

1993-Sept/96 ('000 US$)

Source: US Department of Commerce 1997



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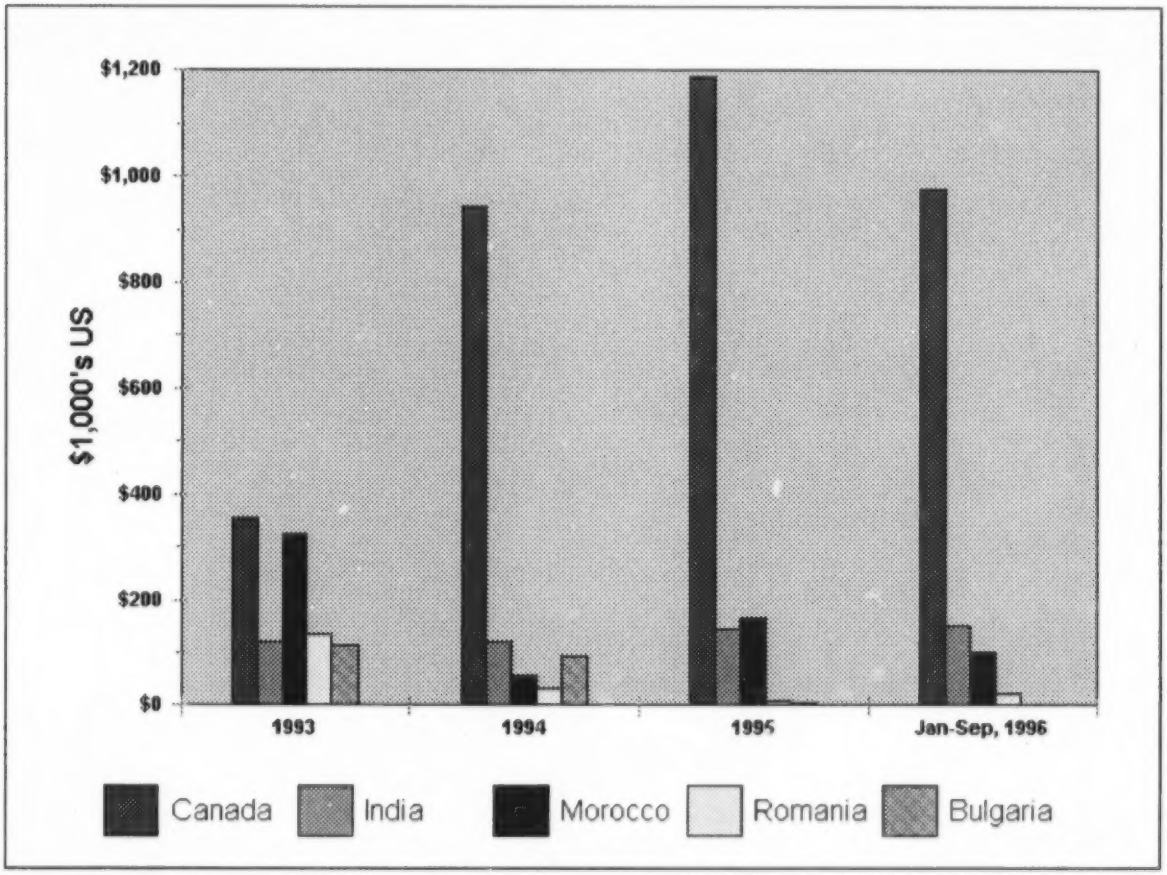
Value of United States imports of coriander from five largest suppliers

1993-Sept/96 ('000 US$)

Source: US Department of Commerce 1997



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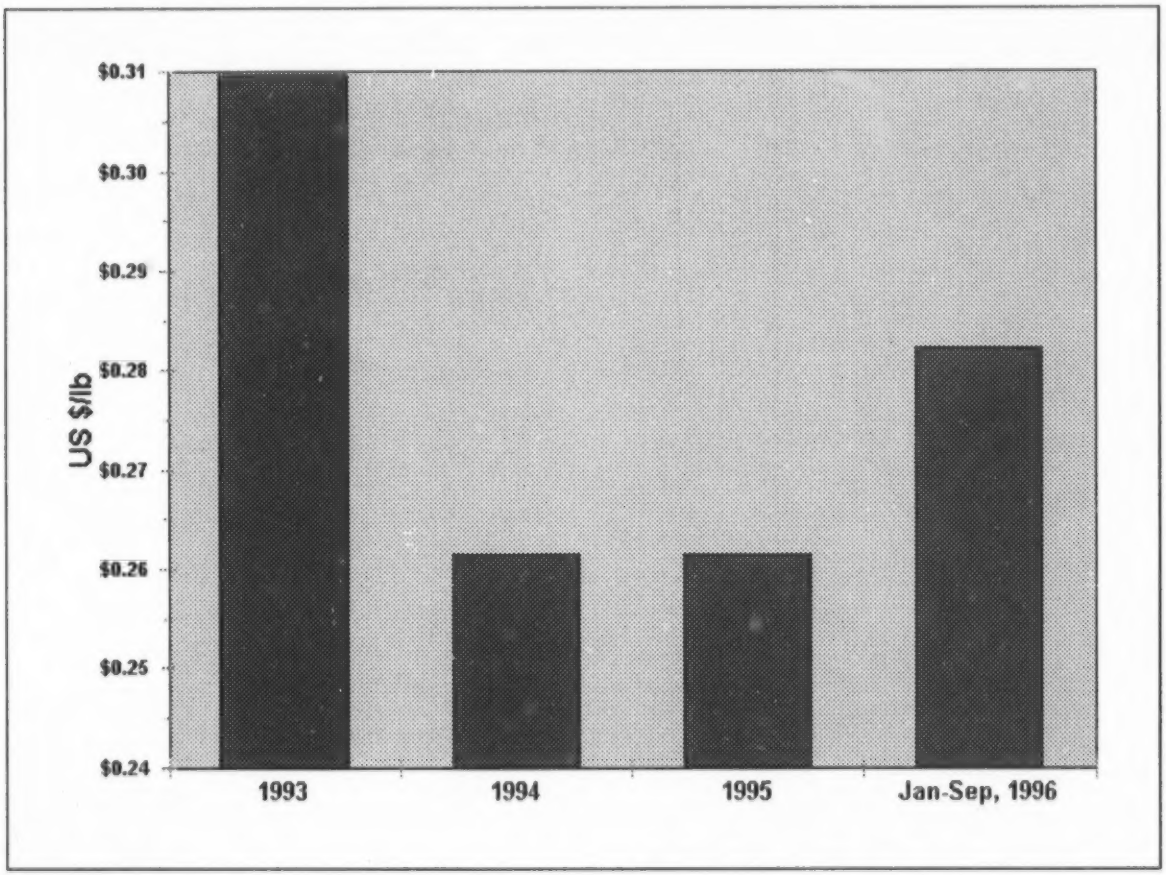
Average price paid for coriander imported by the United States from Canada

1993-Sept/96 (US$/lb)

Source: US Department of Commerce 1997



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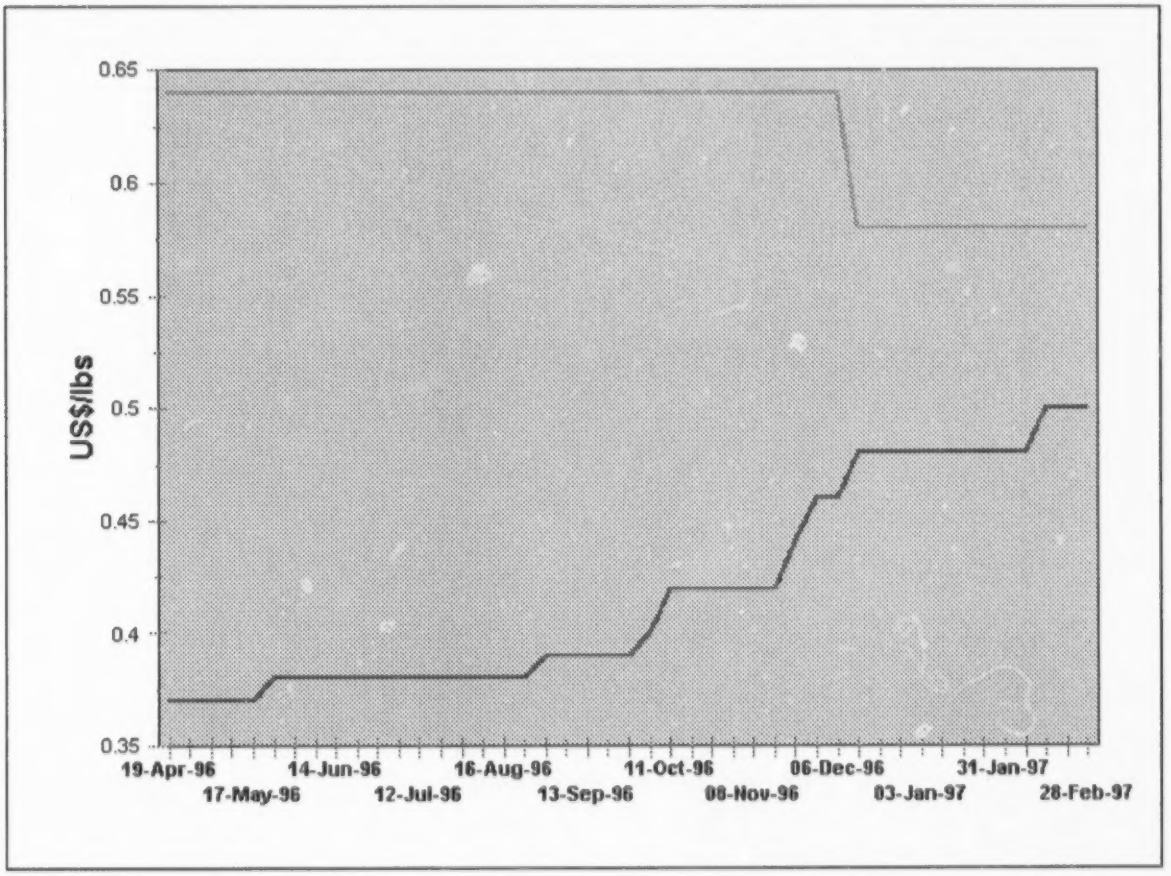
Cleaned and bagged coriander wholesale weekly spot price FOB New York
Source: A.A. Sayia & Company, Inc., Hoboken, N.J. *Weekly Market Report*

Moroccan Canadian



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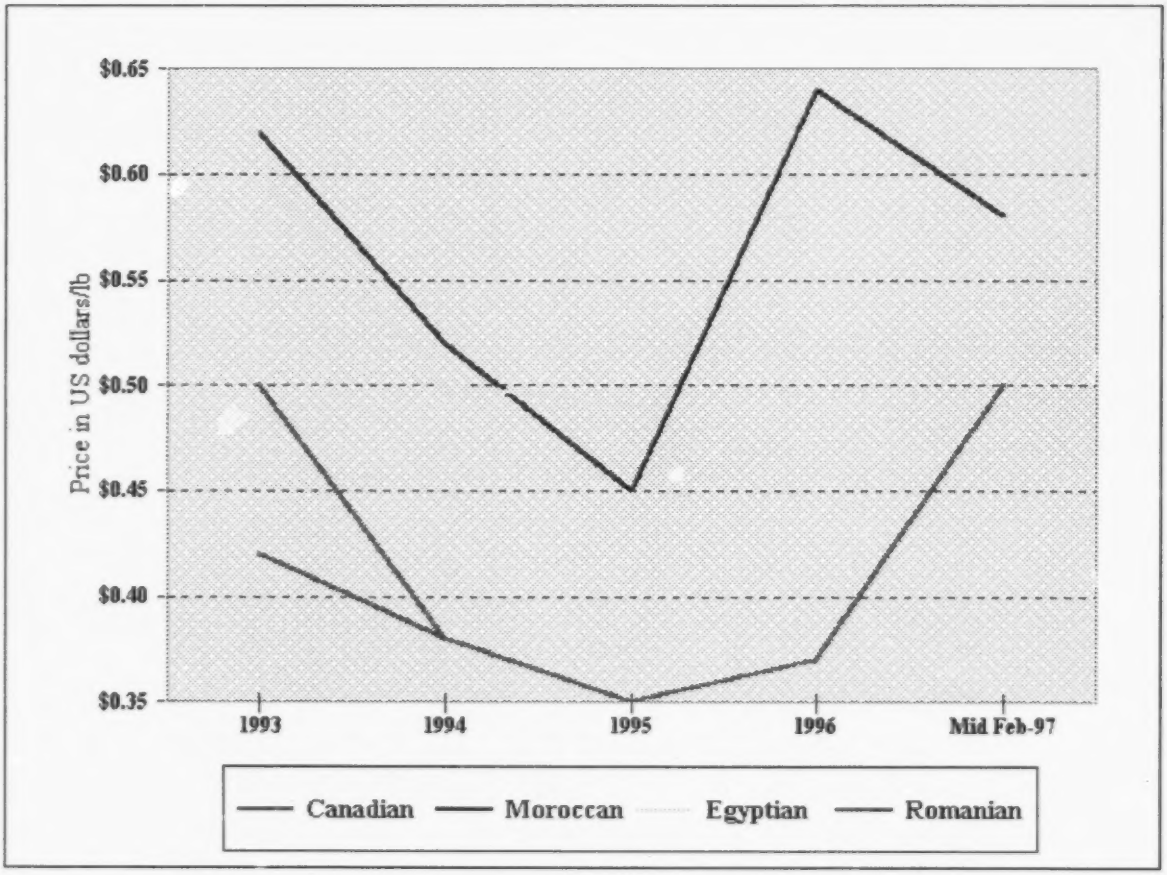
Approximate New York annual wholesale Coriander spot prices
March of each year in US $/lb
Source: USDA Foreign Agriculture Service.
Tropical Products: *World Markets and Trade.*
Circular Series FTROP 1-96



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Marketing

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Several companies trading in special crops in Saskatchewan offer production contracts for coriander. Farm prices for cleaned coriander in recent years have ranged from $.18 - $.38CDN/lb. Prices for planting seed usually run about double the commercial price.

The Saskatchewan Agriculture and Food publication, " Saskatchewan Special Crop Market and Contract Synopsis" is an annually updated listing of the companies buying and contracting coriander and other special crops. The Saskatchewan Herb and Spice Association can provide a list of active brokers and buyers of spices.

The end-use market for coriander exists mainly in the large urban centres of North America. Wholesale prices (annual, weekly) are often based FOB New York, cleaned and bagged. Canadian coriander prices in New York have increased since April 1996 from about 37¢ US per lb to about 54¢ US per lb in August 1997. For up to date FOB New York Prices, contact A.A Sayia and Company Inc. Their Weekly Market report is availalbe for a fee.

Competitors to Canada in the export of coriander are Morocco, Romania, Bulgaria, Argentina and India. Moroccan coriander is often priced lower than Canadian. Production in Canada should focus on high quality and consistent seed size to compete in export markets. More information can be obtained by contacting the following:
American Spice Trade Association, Inc.

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Agriculture and Food
Saskatchewan

Economics of Production

Last Updated: July 15, 1998

The Saskatchewan Agriculture and Food FarmFacts publication, Crop Planning Guide Alternative Crops, provides annually updated information about the costs of production and expected returns from coriander production.

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Additional Information

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- **"A Growers Guide to Herbs and Spices"** contains information on coriander and another 14 herb and spice crops.
  It is available from the Saskatchewan Herb and Spice Association. For more information on this association, contact:
  - Martin Gareau, president - telephone (306) 922-8056 or fax (306) 922-6189 or
  - your local Saskatchewan Agriculture and Food Rural Service Center.

- Canadian Spice Association
  P.O. Box 189
  Don Mills, Ontario
  M3C 2S2

- **"Weekly Market Report"** is available from A.A. Sayia and Company, Inc. This publication lists the New York spot prices for numerous spices including caraway and coriander. The publication is priced at US$150 annually. For information :
  - A.A.Sayia and Company, Inc.
    One Newark Street
    Hoboken, N.J. 07030
    ph: (201) 659-4504
    fax: (201) 659-3167

- **"Spices World"** is available weekly from Market News Service. This publication lists prices for numerous spices and herbs, including caraway and coriander for several markets around the world. The publication is priced at US$ 350/year. For information:
  - Market News Service
    International Trade Centre UNCTAD/GATT
    Palais des Nations
    CH-1211 Geneva 10
    Switzerland
    ph: (+41) 22 730 01 11
    fax: (+41) 22 733 71 76

- **American Spice Trade Association (ASTA)** "Publications Guide" lists a number of publications which may be useful, including ASTA's "Membership Roster", ASTA's "Cleanliness Specifications", "US Spice Consumption Report", and "What You Should Know" brochures. Prices for non-members are quite high for some publications.
  - American Spice Trade Asociation, Inc. (ASTA)
    560 Sylvan Avenue
    P.O. Box 1267
    Englewood Cliffs, N.J. 07632, U.S.A.
    telephone: (201) 568-2163 or fax: (201) 568-7318
    or

ASTA Information Bureau
Lewis and Neale, Inc.
49 E. 21 Street, 8th Floor
New York, NY 10010
telephone: (212) 420 8808 or fax: (212) 254-2452

- **"Tropical Products: World Markets and Trade" USDA** FAS Circular Series FTROP 1 (March) contains US trade and price information on a variety of spices and other commodities. It is a priced publication available from:
  National Technical Information Service
  telephone:(703) 487-4630
  fax:(703) 321 8547
  email: info@NTIS.fedworld.gov or orders@NTIS.fedworld.gov

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